UNITED STATES PATENT APPLICATION

OF

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FOR

DYNAMIC ABSORBER OF WASHING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Application No. P2002-0064331, filed on October 21, 2002, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a washing machine, and more particularly, to a dynamic absorber for a washing machine absorbing vibration that occurs during a wash cycle.

Discussion of the Related Art

[0003] In general, a washing machine is an apparatus removing various contaminants from clothes by using chemical emulsification of detergent and friction with wash water and mechanical impact of a pulsator to the clothes. Such a washing machine is classified into drum, pulsator, and agitator type.

[0004] In a drum washing machine, washing is performed by impact being generated as laundries are raised and dropped by a rotation of a drum. And, in a pulsator and agitator washing

machine, washing is performed by action of detergent and impact being generated as laundries are raised and dropped by a rotation of an agitator or pulsator coupled to a wash shaft being vertically projected in the middle of the washing machine. In the aforementioned washing machines, washing is performed by impact being generated from a mechanical system.

[0005] Hereinafter, a general structure of the pulsator washing machine is explained in reference to drawings. As illustrated in FIG. 1, an outer tub 1 forming a case of a washing machine is provided in a cabinet (not illustrated) for storing wash water. Between the outer tub 1 and the cabinet, a damper (not illustrated) is provided for supporting the outer tub 1 so as to absorb vibration generated during washing and dehydration.

[0006] An inner tub 2 is rotatably provided in the outer tub 1 and a pulsator 3 is provided in the inner tub 2. A balancer 14 is provided for maintaining balance during a rotation of the inner tub at top of the inner tub and a driving motor 5 is provided for rotating the inner tub and the pulsator 3 at a bottom of the inner tub 2.

[0007] Explaining in more detail, a drive shaft 4 is coupled to the pulsator 3 and the driving motor 5 is connected to a bottom end of the drive shaft 4. A bearing housing 8 is provided between the bottom end of the outer tub 1 and the driving motor 5. Bearing 6 and 7 are rotatably provided for supporting the drive shaft 4 at top and a bottom of the bearing housing 8. Accordingly, when the driving motor 5 is operated to rotate the drive shaft 4 left and right, the

pulsator 3 and the inner tub 2 being coupled to the drive shaft 4 rotates each other and generates wash water current so as to wash laundries in the inner tub 2.

[0008] However, a conventional washing machine has problems as followed. First, as illustrated in FIG. 5, a vibration of the inner tub 2 is not increased according to an increase in the number of rotation by an operation of the inner tub 2 and the balancer provided at top of the inner tub 2. However, as a dotted line in FIG. 5, the outer tub 1 has low stiffness and high flexibility, and the number of vibration is continuously increased by the increase in the number of the rotation of the inner tub 2. In the end, the vibration greatly reacts upon driving member such as the bearings 6 and 7, the bearing housing 8 and the drive shaft 4, and causes a damage of parts in an extreme case.

[0009] Second, although the damper is provided to absorb the vibration in the conventional washing machine, the damper is only effective for reducing exceeded vibration in acceleration but not effective for absorbing the vibration of the rated revolution. Therefore, there is a limitation in reducing dehydration time because high-speed dehydration is not performed in the conventional washing machine.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention is directed to a dynamic absorber of washing machine that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0011] An object of the present invention is to provide a dynamic absorber of washing machine that smoothly absorbs vibration at the outer tub during high-speed dehydration.

[0012] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0013] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a dynamic absorber of a washing machine of the present invention includes a fixing member provided at a bottom of the outer tub and a dynamic absorption member being extended from an outer surface of the fixing member, vibrating when the outer tub vibrates and thereby absorbing the vibration of the outer tub. The dynamic absorption member includes an extension member extended from the outer

surface of the fixing member in a radial direction; and a mass member provided around an outer circumference of the extension member.

[0014] The dynamic absorber of the washing machine further includes a supporting member being provided under the bottom of the outer tub and being coupled with the fixing member. The supporting member includes a fixing groove formed on a bottom thereof for receiving a top of the fixing member. The fixing member is formed in a ring form.

[0015] The extension member includes a plurality of equally spaced bars being extended in a radial direction, and the extension member comprises a round plate. A plurality of ribs is provided on a top surface of the extension member for supporting the extension member. The plurality of ribs has a first end connected to the outer surface of the fixing member and a second end being connected to an inner surface of the additional mass member. A bearing housing is provided at the bottom of the outer tub and the fixing member is provided on an outer circumferential surface of the bearing housing.

[0016] In another aspect of the present invention, a washing machine includes a cabinet, an outer tub provided in the cabinet for storing wash water, an inner tub rotatably provided in the outer tub for receiving a load of clothes, a driving motor rotating the inner tub, a drive shaft having a first end coupled to the inner tub and a second end being coupled to the driving motor, a fixing member provided at the bottom of the outer tub, and a dynamic absorption member

extended from an outer surface of the fixing member and vibrating when the outer tub vibrates and thereby absorbing the vibration of the outer tub.

[0017] The dynamic absorption member includes an extension member extended from the outer surface of the fixing member in a radial direction and a mass member provided at an outer end of the extension member.

[0018] A plurality of a bearing housing is provided for supporting the drive shaft at the bottom of the outer tub and the fixing member is provided on an outer circumferential surface of the bearing housing.

[0019] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0021] FIG. 1 illustrates a sectional view of an internal structure of a conventional washing machine;

[0022] FIG. 2 illustrates a sectional view of a washing machine having a dynamic absorber according to the present invention;

[0023] FIG. 3A illustrates a bird-eye view of the dynamic absorber according to the present invention;

[0024] FIG. 3B illustrates a bird-eye view of another form of the dynamic absorber according to the present invention;

[0025] FIG. 3C illustrates a bird-eye view of the other form of the dynamic absorber according to the present invention;

[0026] FIG. 4 illustrates a bird-eye view of the dynamic absorber having a fixing member according to the present invention; and

[0027] FIG. 5 illustrates a graph compared vibration mode of the dynamic absorber according to the present invention with a vibration mode of the conventional washing machine.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible,

the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0029] As illustrated in FIG. 2, an outer tub 1 is provided for storing water in a cabinet of a washing machine and an inner tub 2 is rotatably provided in the outer tub 1. The outer tub 1 is supported by a plurality of dampers (not illustrated) connecting the cabinet of the washing machine (not illustrated) to the outer tub in the washing machine.

[0030] A pulsator 3 is provided in the inner tub 2. The pulsator 3 is coupled to top end of a drive shaft 4, and a driving motor rotating the drive shaft 4 is coupled to a bottom end of the outer tub 1. A bearing housing 8 having bearings 6 and 7 at top and bottom for rotatably supporting the drive shaft 4 is provided between the bottom end of the outer tub 1 and the driving motor 5. A dynamic absorber 10 is provided for absorbing vibration generated from the outer tub 1 on an outer surface of the bearing housing 8 when the inner tub 2 is rotated by rotation of the drive shaft 4.

[0031] The dynamic absorber 10 includes a fixing member 11 adhered to the outer surface of the bearing housing 8 and a dynamic absorption member as illustrated in FIG. 3a. The dynamic absorption member includes an extension member and a mass member 13. An extension member in a round plate form is extended from the outer circumferential surface of the fixing member 11 in a radial direction and vibrates, and the mass member 13 is provided around

an outer circumferential surface of the extension member 12. The mass member 13 vibrates with the extension member 12 during vibration of the outer tub 1 and absorbs vibration of the outer tub 1 at higher speed.

[0032] The fixing member 11 can be formed in various forms. For example, in case that the fixing member 11 is adhered to an outer circumferential surface of a cylindrical bearing housing 8, it is formed in a ring form. The extension member 12 includes a metal plate or a plastic round plate, the metal plate having a fixed stiffness and vibrating. Also, the mass member 13 can be formed in various forms for more effective vibration absorption.

[0033] There are number of ribs 12a having a first end being connected to the outer circumferential surface of the fixing member 11 and a second end connected to the inner circumferential surface of the added mass member 13 on a top surface of the extension member 12 as illustrated in FIG. 3B. The ribs 12a support and complete the extension member during vibration of the extension member 12. The ribs 12a is formed at a bottom surface of the extension member 12 or both a top and bottom surfaces of the extension member. Also, as illustrated in FIG. 3c, the extension member 12 includes a plurality of equally spaced bars being extended in a radial direction.

[0034] Meanwhile, the structural elements of the dynamic absorber 10 can be separately produced and assembled, or all can be formed as a single body. In this case, either the extension

member 12 and the mass member 13 or the fixing member 11 and the extension member 12 are formed as a single body. Also, each element forming the dynamic absorber 10 can be attached to and detached from each other.

[0035] The stiffness and the mass of the extension member 12 and the mass member 13 of the dynamic absorber 10 are tuned properly for a fixed vibration mode during dehydration. The tuning is set to the stiffness, volume of the outer tub 1 and the rated rotation during dehydration.

[0036] The following is an operation of dynamic absorber 10 with an aforementioned composition according to the present invention. When dehydration of the washing machine is started, the drive shaft 4 rotates by operation of the driving motor 5, and dehydration is performed by high-speed rotation of the pulstor 3 and the inner tub 2.

[0037] At this time, vibration is generated from the rotation of the drive shaft 4 and the inner tub 2. This vibration is transmitted to the bearing housing 8. And, the extension member 12 and the mass member of the dynamic absorber 10 vibrate up and down so as to absorb vibration of outer tub 1.

[0038] As illustrated in FIG. 4, the outer tub 1 includes a supporting member 14 having an end surface being formed in form and having a fixing groove 14a on the bottom surface of the outer tub 1. The fixing member 11 can be put in the fixing groove 14a of the supporting

member 14 and fixed by a screw (not illustrated). Ribs (not illustrated) for fixing can be formed additionally to support the fixing member 11 at the supporting member 14.

[0039] The form of the supporting member 14 is various and not limited to a form being illustrated in FIG. 4. Instead of providing the supporting member 14 separately, the fixing member can be fixed at a bottom of the outer tub 1 by using a screw (not illustrated.) The dynamic absorber can be adhered to an outside of a gear housing in which a gear unit is provided in a washing machine including a clutch and a gear unit in a driving device.

[0040] The effect of the present invention is followed. First, during dehydration, relative vibration is generated from the inner tub 1 according to high-speed rotation of the inner tub 2 and absorbed by the dynamic absorber 10. The vibration absorbency is more excellent compared to that of the conventional washing machine. Second, low vibration and low noise are realized during dehydration. Third, vibration being generated from the relative vibration of the outer tub 1 and being transmitted to the driving member is reduced, and it protects parts so as to prolong life. Fourth, during dehydration, vibration from a predetermined number of rotations can be reduced by tuning the stiffness and the mass of the dynamic absorber 10, and the number of rated rotations can be set to a high number in order that the dehydration time is reduced.

[0041] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the

inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.